

On Nov 3 I will be presenting at a conference in the D.C. area, hosted by the U.S. Department of Homeland Security on the future of biology. The title and abstract are below. There will be only six slides with almost no words, consisting of PAO-type NASA pictures of Earth, Space, ISS, Orion capsule, biological specimens, space radiation environment, exercise on ISS etc. The theme is biological challenges to planetary exploration and settlement, speculation about long-term human evolution, and the role emerging biological technology may play in bridging the gaps.

*Abstract:*

**Micro to the Macro Biome  
Can Biology Affect the Big Picture through Small Changes?**

**Lee Morin MD PhD  
Johnson Space Center**

**Life has had a profound impact on the geological history of our planet, which in turn has had a profound impact back on the evolution of life. Life has been able to adapt and spread into every planetary nook and cranny. At this point in history, life is becoming able to engineer itself, with extreme consequences we are only dimly able to foresee. One probable outcome will be the facilitation of the expansion of the range of life to beyond our planetary cradle, an evolutionary step as profound as the ancient transition from sea to land. Current efforts at NASA and aboard the International Space Station will be discussed in this context.**

# **From the Micro to the Macro Biome**

**Can biology affect  
the Big Picture  
through small  
changes?**

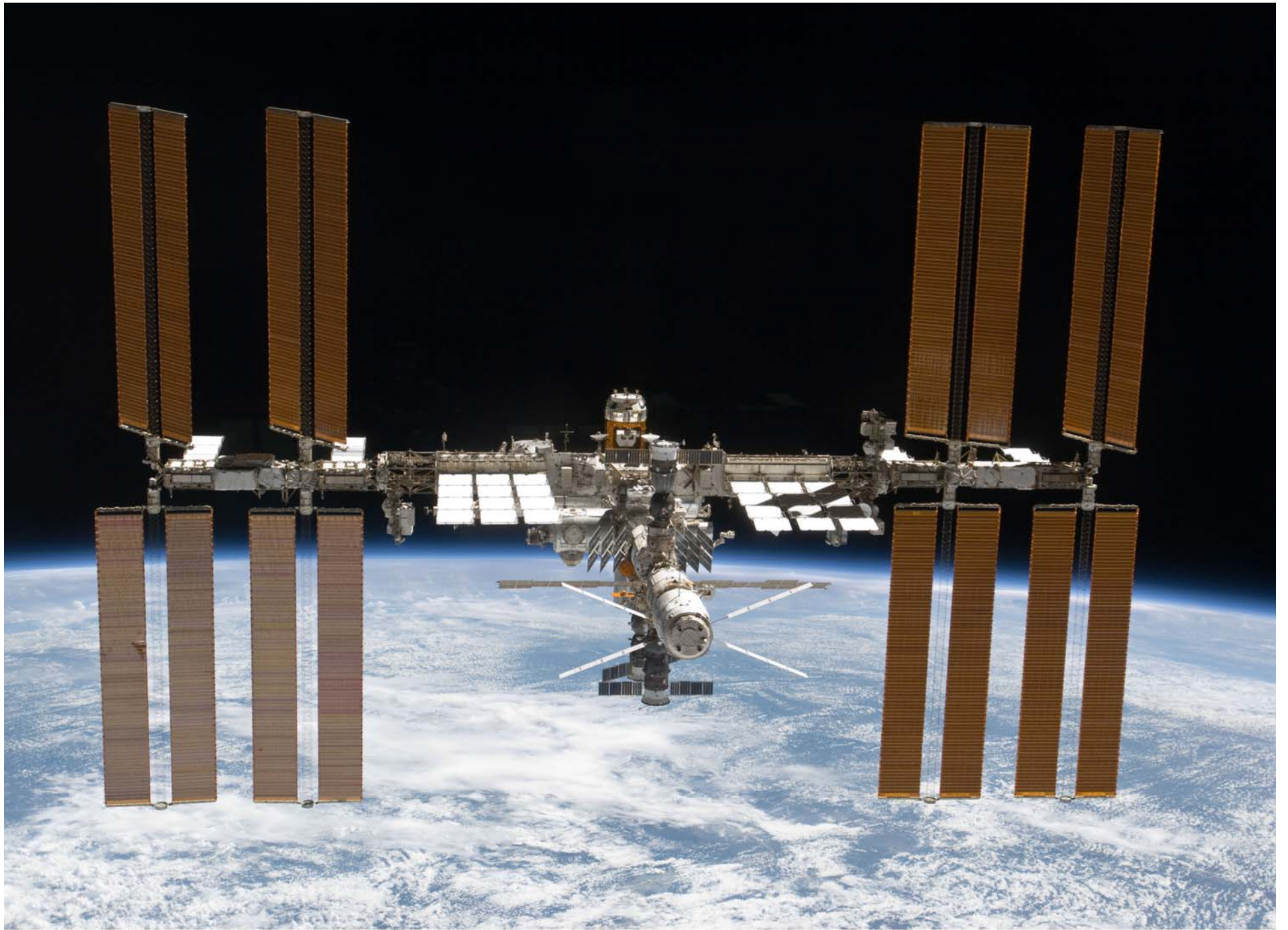
**Lee Morin MD PhD  
CAPT MC USN (Ret)**











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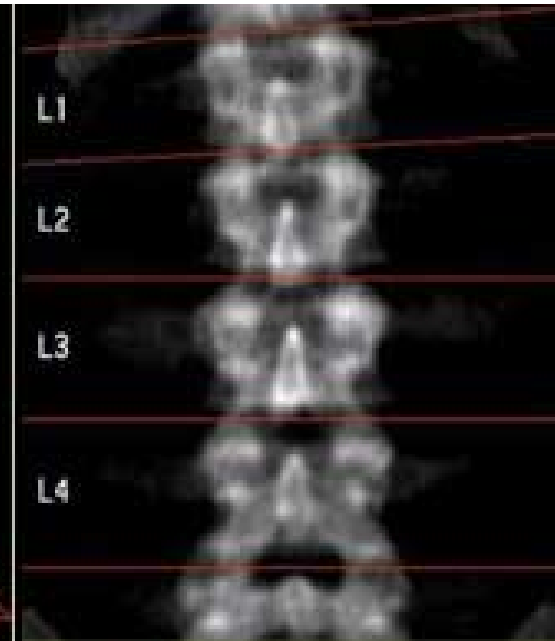
This diagram illustrates the interaction of cosmic rays with Earth's magnetic field. On the left, a bright orange and red flame-like structure represents the Sun. A stream of particles, labeled 'Solar Protons & Heavier Ions', flows from the Sun towards the Earth. The Earth is depicted as a small blue sphere with a magnetic field represented by yellow and blue lines. These lines are concentrated at the poles, forming loops that trap particles, as indicated by the label 'Trapped Particles' and an arrow pointing to the inner loops. The background is dark with faint, wavy lines representing the galactic cosmic ray flux, labeled 'Galactic Cosmic Rays'.

Galactic Cosmic Rays

Solar Protons  
&  
Heavier Ions

Trapped Particles





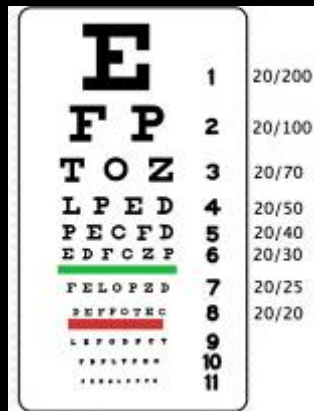
# Visual Impairment Intracranial Pressure Project Syndrome Signs

## Background:

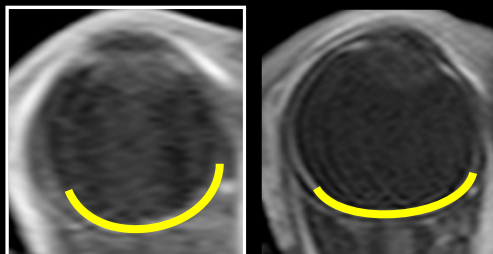
- 15 known “clinical cases” (of 36 U.S. long duration ISS crew) members
  - Each with different degrees of symptoms
  - Some with elevated measures of Intracranial Pressure (ICP) post flight
  - Incidence numbers vary with criteria and time period

### •Hyperopic Shifts

-Up to +1.75 diopters



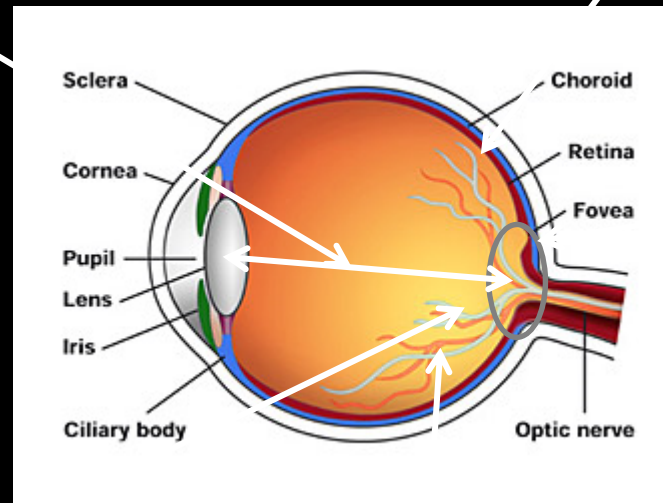
### •Globe Flattening



Normal Globe

Flattened Globe

MRI Orbital  
Image  
showing  
globe  
flattening



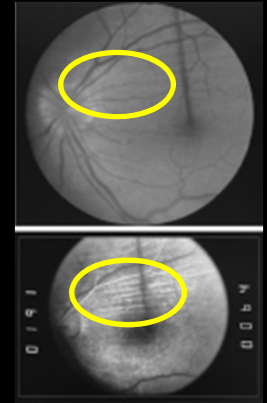
### •Altered Blood flow

•“cotton wool” spots



### •Choroidal Folds -

parallel grooves in the posterior pole

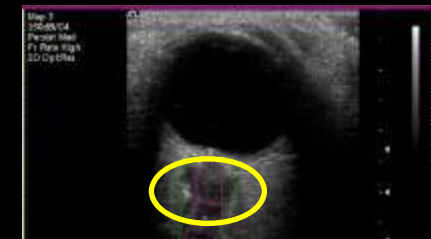


### •Optic Disc Edema (swelling)

ICP



### •Increased Optic Nerve Sheath Diameter





# ISS Medical Support

